Chemical characterization of the algistatic fraction of barley straw (*Hordeum vulgare*) inhibiting *Microcystis aeruginosa*

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Introduction

The algistatic properties of barley straw (*Hordeum vulgare*) have been observed in laboratory studies and *in situ.* Laboratory studies have produced inhibition as well as stimulation of growth in freshwater and marine species. While taxa known to be inhibited have increased, comparatively little has been done to isolate and classify the compound(s) responsible for the algistatic effect.

Hypotheses

The aim of this study was to confirm and characterize the nature of the toxic component(s) in decomposing barley straw that inhibit the growth of *Microcystis aeruginosa*.

Methods

A microplate assay system was developed using *M. aeruginosa* to help isolate and identify the inhibitory components of barley straw extract. *M. aeruginosa* was selected for the bioassay as it has been consistently inhibited by barley straw extract in studies conducted in our laboratory and by others. The 24-well plate assay utilizes *in vivo* fluorescence monitoring with a TECAN GENios plate reader for determination of chlorophyll-a levels in each 2 mL culture.

Results

Fractionation and partial characterization of inhibitory extracts prepared using several different procedures suggests the inhibitors are polyphenolics with molecular weights between 1000 and 3000. Percolation of the aqueous extract through a Polyamide CC6 resin or through various MW cutoff filters resulted in the loss of algistatic activity, which confirms this assertion. Hydrolysis of the extract resulted in little change in the activity profile. Fractionation by HPLC methods yielded a highly potent multi-compound fraction, which is algicidal at 353 mg L^{-1} and algistatic between 11.1 – 3.53 mg L^{-1}.

Conclusion

The consistent inhibition of *M. aeruginosa* observed by ourselves and several other investigators suggests that the algistatic components of barley straw may be useful in the management of *M. aeruginosa in situ*. In the Chesapeake Bay region recent closures of public beaches in response to *M. aeruginosa* blooms and the presence of microcystin in livers of great blue herons in a recent mortality event emphasizes the need for management methods.